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February 1, 2015

Sherri Stumbo
USDA Forest Service
4350 South Cliffs Dr.
Pocatello, ID 83204

Subject: Biological Selenium Removal Treatment Technology
Fluidized Bed Bioreactor Pilot Study
December 2015 Progress Report

Dear Sherri,

This progress report summarizes key activities in December 2015 associated with the fluidized bed bioreactor (FBR) pilot study located near Hoopes Spring. This pilot study is being conducted as part of the Smoky Canyon Mine Remedial Investigation/Feasibility Study (RI/FS) to provide information on the effectiveness of the active biological treatment system in removing selenium and other COPCs from South Fork Sage Creek Springs and Hoopes Spring. Operation and monitoring of the pilot study follows the *Pilot Study Work Plan and Sampling and Analysis Plan (Work Plan/SAP), Biological Selenium Removal Treatment Technology Fluidized Bed Bioreactor* (prepared by Formation Environmental, dated September 2014, with revised text and tables dated March 5, 2015), along with Work Plan/SAP Addenda 01, 02, and 03 which Simplot submitted to the Agencies (and were subsequently approved) in the summer of 2015.

The FBR system had been shut down between August and the second week of October due to the presence of filamentous sulfide oxidizing bacteria in the aeration tank and the sand filter. An oxidation system was installed in October to dose treated water with a 27% hydrogen peroxide solution to remove sulfides and kill the bacteria. The FBR system was then operated continuously from the second week of October through the end of November. The oxidation system performed to design specifications, and the filamentous sulfide oxidizing bacteria colonies in the aeration tank appeared to be decreasing.

The treatment system was shut down again on November 30, 2015 due to head loss through the sand filter and the presence of biological growth at the treatment system outfall. Due to the ongoing operational challenges, samples were sent to two separate laboratories in early December for biological analysis. The results of these analyses indicated that the environment in the treatment system favored biofilm-forming microorganisms, not the floc-forming microorganisms the system was designed to filter.

To address this increased understanding, Work Plan/SAP Addendum 04, Pilot Test Plan: Nutrient Dosing, was submitted to the Agencies on December 10, 2015. This addendum presented a plan to add a nutrient dosing system to encourage growth of the preferred floc-building microorganisms. Additional information regarding the proposed plan was requested by the Agencies on December 10, 2015. There were no further submittals in December.

Identification of Deliverables and Data Transmittals

Laboratory data were received for the November samples (Table 1.1 and Table 1.2). Field data for November were previously reported in the November monthly report, but are reproduced in this report for presentation with the corresponding laboratory data (Table 2.0).

Upcoming Activities

The following activities associated with the FBR pilot study are planned through February 2016, or have occurred as of the date of this progress report:

- Resolution of agency comments and subsequent approval of Work Plan/SAP Addendum 04 Revision 2 by the agencies;
- Implementation of modifications to the treatment plant, followed by restarting the system during the week of January 18;
- Initiation of performance monitoring during the last week of January (week 0 monitoring as specified in Work Plan/SAP Addendum 01); and
- Continuation of weekly monitoring.

Please contact me if there are questions regarding this monthly progress report.

Sincerely,

Monty Johnson
Environmental Engineering Manager
J. R. Simplot Company

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Table 1.1
Laboratory Results Full Analyte List

		Week 3	
	Station >>	Influent	Effluent
	Sample ID >>	SC1115-LSSHS-IN002	SC1115-LSSHS-EF002
	Date >>	11/10/2015	11/10/2015
Analyte	Units		
General Chemistry			
Ammonia as N	mg/L	0.026 U	0.176
Bicarbonate	mg/L	210	190
Biochemical Oxygen Demand	mg/L	2 U	9
Carbonate	mg/L	1 U	1 U
Chemical Oxygen Demand	mg/L	5 U	5 U
Calcium, Dissolved	mg/L	59.2	59.1
Magnesium, Dissolved	mg/L	22.6	22.3
Potassium, Dissolved	mg/L	0.693	0.701
Sodium, Dissolved	mg/L	5.97	5.91
Chloride	mg/L	6.97	6.81
Fluoride	mg/L	0.267	0.0339 J
Hardness	mg/L	241	239
Nitrate as N	mg/L	0.33	0.13
Nitrate/Nitrite as N	mg/L	0.326	0.125
Sulfate as SO4	mg/L	36.6	29.6
Total Alkalinity	mg/L	210	190
Total Dissolved Solids	mg/L	252	278
Total Organic Carbon	mg/L	0.5 U	3.34
Total Phosphorus as P	mg/L	0.0355	0.168
Total Sulfide	mg/L	1 U	1 U
Total Suspended Solids	mg/L	2 U	2 U
Metals and Metalloids			
Aluminum, Dissolved	mg/L	0.0076 U	0.0076 U
Aluminum, Total	mg/L	0.0571 J	0.0387 J
Antimony, Dissolved	mg/L	0.0000732 U	0.0001 J
Antimony, Total	mg/L	0.0000732 U	0.00009 J
Arsenic, Dissolved	mg/L	0.000398 U	0.000398 U
Arsenic, Total	mg/L	0.00041 J	0.000398 U
Barium, Dissolved	mg/L	0.0507	0.0478
Barium, Total	mg/L	0.0505	0.0482
Beryllium, Dissolved	mg/L	0.000047 U	0.000047 U
Beryllium, Total	mg/L	0.000047 U	0.000047 U
Boron, Dissolved	mg/L	0.0112 J	0.0141 J
Boron, Total	mg/L	0.0119 J	0.0141 J
Cadmium, Dissolved	mg/L	0.0000362 U	0.0000362 U
Cadmium, Total	mg/L	0.0000362 U	0.0000362 U
Chromium, Dissolved	mg/L	0.00076 J	0.00022 J
Chromium, Total	mg/L	0.00076 J	0.00023 J
Cobalt, Dissolved	mg/L	0.00007 J	0.00007 J
Cobalt, Total	mg/L	0.00007 J	0.00007 J
Copper, Dissolved	mg/L	0.0000418 U	0.00018 J
Copper, Total	mg/L	0.0000418 U	0.00018 J
Iron, Dissolved	mg/L	0.01 U	0.01 U
Iron, Total	mg/L	0.0673	0.274
Lead, Dissolved	mg/L	0.0000554 U	0.0000554 U
Lead, Total	mg/L	0.0000554 U	0.0000554 U
Manganese, Dissolved	mg/L	0.00117	0.00185
Manganese, Total	mg/L	0.00121	0.00197
Mercury, Dissolved	mg/L	0.000018 J	0.000026 J
Mercury, Total	mg/L	0.000054 J	0.000054 J

Table 1.1
Laboratory Results Full Analyte List

		Week 3	
	Station >>	Influent	Effluent
	Sample ID >>	SC1115-LSSHS-IN002	SC1115-LSSHS-EF002
	Date >>	11/10/2015	11/10/2015
Analyte	Units		
Molybdenum, Dissolved	mg/L	0.00177	0.00114
Molybdenum, Total	mg/L	0.00127	0.00096 J
Nickel, Dissolved	mg/L	0.00023 J	0.00796
Nickel, Total	mg/L	0.0002 J	0.00788
Selenium, Dissolved	mg/L	0.127	0.0094
Selenium, Total	mg/L	0.123	0.00931
Silver, Dissolved	mg/L	0.0000172 U	0.0000172 U
Silver, Total	mg/L	0.0000172 U	0.0000172 U
Thallium, Dissolved	mg/L	0.0000657 U	0.0000657 U
Thallium, Total	mg/L	0.0000657 U	0.0000657 U
Uranium, Dissolved	mg/L	0.00165	0.00165
Uranium, Total	mg/L	0.00163	0.00169
Vanadium, Dissolved	mg/L	0.00146 J	0.00068 J
Vanadium, Total	mg/L	0.00148 J	0.00071 J
Zinc, Dissolved	mg/L	0.00162 J	0.00305 J
Zinc, Total	mg/L	0.0027 J	0.00293 J

Notes:
Results presented are preliminary, and have not been validated at the time of this report.
U - Analyte not detected above the method detection limit (MDL).
J - Result is estimated.

Table 1.2
Laboratory Results Focused Analyte List

		Week 4		Week 5	
	Station >>	**Influent**	**Effluent**	**Influent**	**Effluent**
	Sample ID >>	SC1115-LSSHS-IN003	SC1115-LSSHS-EF003	SC1115-LSSHS-IN004	SC1115-LSSHS-EF004
	Date >>	11/18/2015	11/18/2015	11/24/2015	11/24/2015
Analyte	**Units**				
General Chemistry					
Nitrate as N	mg/L	0.34	0.13	0.34	0.04 J
Total Phosphorus as P	mg/L	0.0229	0.0396	0.027	0.0423
Total Sulfide	mg/L	1 U	1 U	1 U	1 U
Metals and Metalloids					
Selenium, Dissolved	mg/L	0.122	0.00817	0.114	0.00841
Selenium, Total	mg/L	0.117	0.00773	0.119	0.00807

Notes:
Results presented are preliminary, and have not been validated at the time of this report.
U - Analyte not detected above the method detection limit (MDL).
J - Result is estimated.

Table 2.0
Field Water Quality Data

Week 3	Station >>	Influent	Effluent
	Sample ID >>	SC1115-LSSHS-IN002	SC1115-LSSHS-EF002
	Date >>	11/10/2015	11/10/2015
Analyte	**Units**		
Dissolved Oxygen	mg/L	7.63	8.26
ORP	mV	141	144
pH	SU	7.61	7.68
SC	umhos/cm	426	471
Temperature	C	12.08	13.06
Turbidity	NTU	1.1	8.7

Week 4	Station >>	Influent	Effluent
	Sample ID >>	SC1115-LSSHS-IN003	SC1115-LSSHS-EF003
	Date >>	11/18/2015	11/18/2015
Analyte	**Units**		
Dissolved Oxygen	mg/L	7.96	7.98
ORP	mV	149	146
pH	SU	7.81	7.67
SC	umhos/cm	451	471
Temperature	C	12.51	13.03
Turbidity	NTU	1.3	7.6

Week 5	Station >>	Influent	Effluent
	Sample ID >>	SC1115-LSSHS-IN004	SC1115-LSSHS-IN004
	Date >>	11/24/2015	11/24/2015
Analyte	**Units**		
Dissolved Oxygen	mg/L	7.57	8.5
ORP	mV	160	158
pH	SU	7.74	7.57
SC	umhos/cm	446	446
Temperature	C	12.62	13
Turbidity	NTU	1.3	8